TOPIC: THE LAW OF COSINES

Intro to Law of Cosines

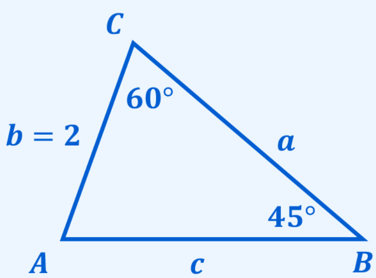
Law of Sines			Law of Cosines	
ASA	SAA	SSA	SAS	SSS

◆ Sometimes you won't be given a side & its *opposite* angle, so you CANNOT use the **Law of Sines**!

- Instead, use the **Law of Cosines**, which relates the __________ of all 3 triangle sides to a *known* _________.

EXAMPLE Solve for the missing side length c.

Recall — **Law of Sines**

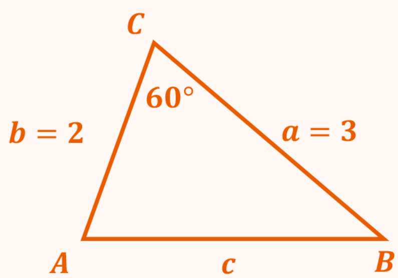


$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$\frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c = \sin(60°) \cdot \frac{2}{\sin(45°)} = 4.9$$

New — **Law of Cosines**



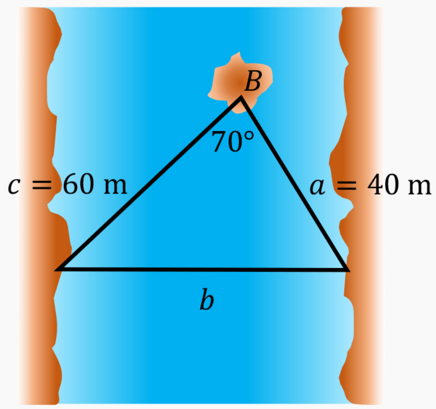
$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cdot \cos B$$

$$c^2 = \_\_\_^2 + \_\_\_^2 - 2\_\_\_\_\_ \cdot \cos\_\_\_$$

TOPIC: THE LAW OF COSINES

PRACTICE A surveyor wishes to find the distance across a river while standing on a small island. If she measures distances of $a = 40\text{ m}$ to one shore, $c = 60\text{ m}$ to the opposite shore, and an angle of $B = 70°$ between, find the distance between the two shores.



Recall

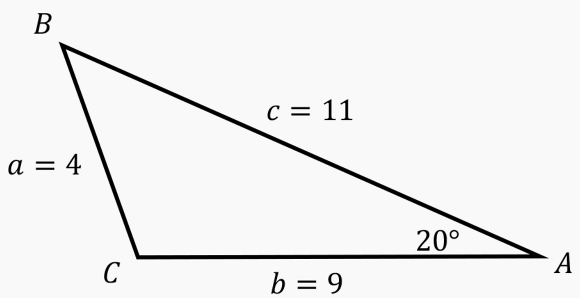
$a^2 = b^2 + c^2 - 2bc \cdot \cos A$

$b^2 = a^2 + c^2 - 2ac \cdot \cos B$

$c^2 = a^2 + b^2 - 2ab \cdot \cos C$

(*Law of Cosines*)

PRACTICE Use the **Law of Cosines** to find the angle $\boldsymbol{C}$, rounded to the nearest tenth.



Recall

$a^2 = b^2 + c^2 - 2bc \cdot \cos A$

$b^2 = a^2 + c^2 - 2ac \cdot \cos B$

$c^2 = a^2 + b^2 - 2ab \cdot \cos C$

(*Law of Cosines*)

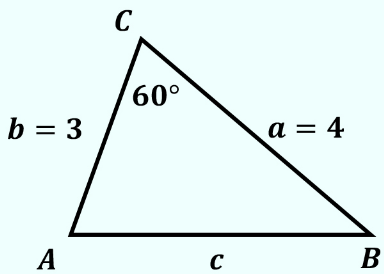
TOPIC: THE LAW OF COSINES

Solving SAS & SSS Triangles

Law of Sines			Law of Cosines	
ASA	SAA	SSA	SAS	SSS

◆ Use the **Law of Cosines** to solve SAS & SSS triangles.

EXAMPLE Solve the triangle: $a = 4, b = 3, C = 60°$



HOW TO: Solve SAS & SSS Triangles

1) Sketch triangle, label given info

2) Use **Law of Cosines**:
- 2a) If SAS, find the 3rd side
- 2b) If SSS, find any angle

3) Use **Law of Cosines** to find a 2nd angle

4) Use $A + B + C = 180°$ to find 3rd angle

Recall

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cdot \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cdot \cos C$$

(*Law of Cosines*)

◆ **Note:** In Step 3, it's better to use the **Law of Cosines** instead of **Law of Sines** because $\cos^{-1}$ only yields 1 angle!

TOPIC: THE LAW OF COSINES

PRACTICE Solve the triangle: $b = 5,\ c = 3,\ A = 100°$

HOW TO: Solve SAS & SSS Triangles

1) Sketch triangle, label given info

2) Use **Law of Cosines**:

2a) If SAS, find the 3rd side

2b) If SSS, find any angle

3) Use **Law of Cosines** to find a 2nd angle

4) Use $A + B + C = 180°$ to find 3rd angle

Recall

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cdot \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cdot \cos C$$

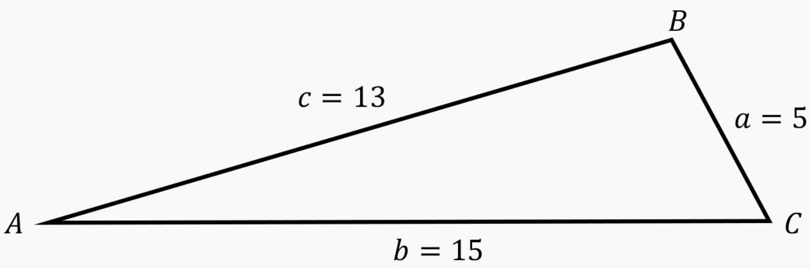
(*Law of Cosines*)

$$A + B + C = 180°$$

(*Angle Sum Formula*)

TOPIC: THE LAW OF COSINES

PRACTICE Solve the triangle: $a = 5,\ b = 15,\ c = 13$



HOW TO: Solve SAS & SSS Triangles

1) Sketch triangle, label given info

2) Use **Law of Cosines**:

2a) If SAS, find the 3rd side

2b) If SSS, find any angle

3) Use **Law of Cosines** to find a 2nd angle

4) Use $A + B + C = 180°$ to find 3rd angle

Recall

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cdot \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cdot \cos C$$

(*Law of Cosines*)

$$A + B + C = 180°$$

(*Angle Sum Formula*)